

Technology: The Bridge to Facilitate Learning of Adult Learners of Mathematics

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Abstract

With the advent of many adults returning back to college, math professors all over the country have been trying to find ways to facilitate adult student learning. Many students have been out of school for over ten or more years and are now required to take college algebra (in an accelerated format). However, many adult learners have forgotten facts of basic math. Although some adult students will need heavy remediation of the subject matter regardless of the venue, there must be a way to help adult learners recall basic math and algebra facts.

This paper seeks to explore whether or not blended courses using MyMathLab/MathXL are effective in expediting learning in developmental math courses such as basic math, elementary and intermediate algebra. Research concerning adult learners and technology is significant because learning new technology along with mathematics would seemingly pose an even bigger challenge than just recalling and learning basic math and algebra facts alone.

Why Technology for Adult Learners of Math?

Many adult math learners have not seen math in ten (10) or twenty 20 years. For their given degree program, college algebra is required, but they cannot remember basic math facts. With the notion of andragogy, some adult students are misplaced in accelerated (5 and 8 week) courses because previous life experiences, however this does not correlate in most math courses. Most adult learners need excessive remediation in order to fulfil the requirements of College Algebra due to no prior knowledge of the subject matter, lack of prior knowledge of the subject matter, inaccurate knowledge relating to the subject matter. There are misconceptions, preconceptions and illogical reasoning that adult learners must overcome. Many adult students have math phobias and math anxiety. Some adult students have little or no exposure to the computer and technology related to the math courses that they are taking (e.g, graphing calculators, pda's) In addition, many adult math learners lead busy lives and do not have extra time to study in order to fill in gaps in their learning.

Adult learners of mathematics face the same challenges that a typical math student may face. For example, they may know the material, but cannot remember it. Since there have been removed from an academic setting for so many years, many adult learners of mathematics may have poor study habits and note taking skills.

Other challenges that adult learners of mathematics face include time management and finding what Elayn Martin-Gay calls “teachable, math learning moments.”¹ Moreover, working adult learners do not retain much of the material being presented in night classes, especially those with busy schedules in the day. Adult Students can follow the professor during class, but cannot retain the same level of understanding once they attempt the homework assignment outside of class.

As previously stated, adult student learners of mathematics face the same challenges as a typical math student. Victory University provides a robust college learning environment which admits over 600 students annually. The average age of a Victory University student is 35. Thus, specifically addressing the needs of the adult learner is essential. This paper will assess the current status of adult learners of mathematics taking developmental courses at Victory University as well as consider the use of mathematical educational software as a means of enhancing the performance rates of adult learners of mathematics in developmental courses.

Methods

The analysis in this paper considers data taken from 433 students of Victory University (formerly known as Crichton College) who have taken math courses between the fall of 1991 until the fall of 2011. Student age and final grade has been taken into consideration. There were a few sections of the LE Basic Math Courses were given Satisfactory/Unsatisfactory assessments at the end of the course. These grades were tabulated as either 2.0=C for Satisfactory or 0=F for Unsatisfactory. Students who withdrew from the course or received an FA grades were translated as 0=F.

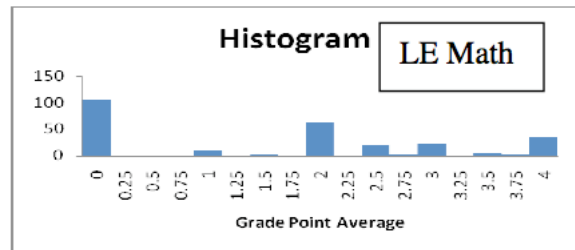
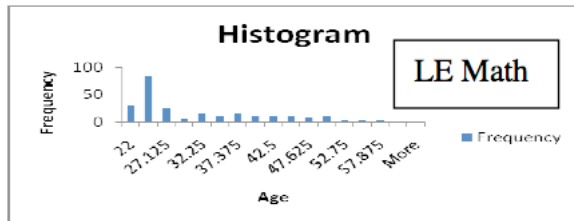
Hypothesis: Adult learners between the ages of 45-80 will have lower grade point averages than the traditional 18-26 year old student. In addition, the grades will be reviewed from two LE0114 Basic Math Courses taught by the author of this paper. The first course was given in the Fall of 2008 and the second course was given in the Spring of 2011. The course in the Spring of 2011 was a hybrid course that included MyMathLab mathematical learning software. The course given in the Fall of 2008 was given in a traditional format. The final component of this research paper examines individual adult student learners of mathematics. In particular, four students over 59 years of age were observed over the course of a semester in basic math, elementary and intermediate algebra. Two students were observed between the ages of 40-45, who openly shared their challenges in intermediate algebra.

Results

From the fall of 1991 until the fall of 2011, there were 260 students who had recorded grades for LE Basic Math at Victory University. The average age of the students taking LE Basic Math courses is 32 and unfortunately the average grade is 1.61 (D). The following histograms provide the age and grade demographics for each student.

¹ Martin-Gay, E. (2009). *Beginning & Intermediate Algebra* (4th ed.). University of New Orleans: Prentice Hall.

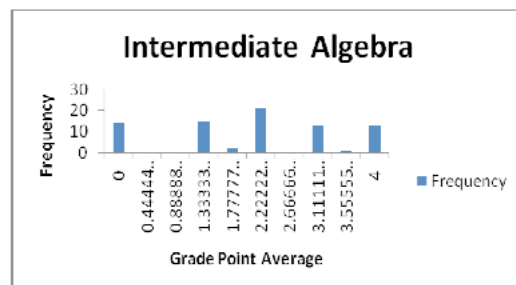
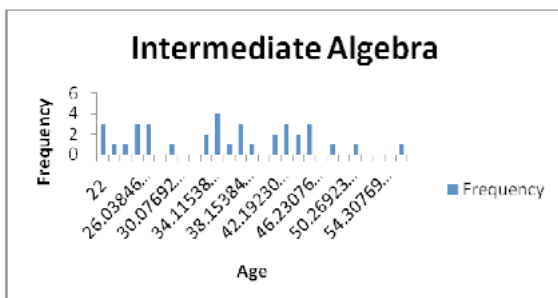
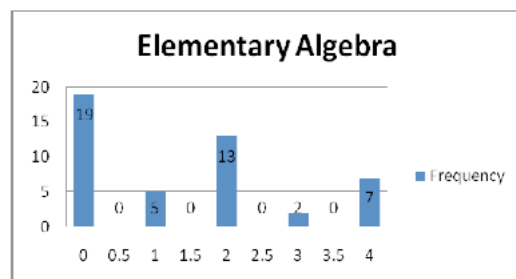
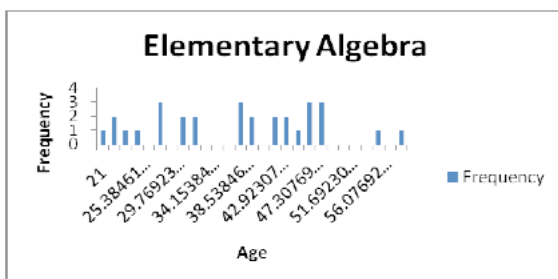
Because the regression coefficient $r = .0412$, the data also reveals that there is no



correlation between age and the grade in the course. Since there is no correlation, it is erroneous to assume that older students would perform better or worse in LE mathematics. Yet the grade point average

for students 45 and older in LE mathematics, which is 1.72, is slightly higher than the group average. These results reveal that most students taking LE Basic Math have challenges passing the course.

The results for the Elementary and Intermediate Algebra courses are similar. Of the 30 recorded students who have taken elementary algebra from the Fall of 2008 until Fall 2009, the average age is 37 and the average grade is 1.43 (D). The correlation coefficient is $r = .25$ —this implies that there is no relationship between the student's age and grade in Elementary Algebra. Yet again, the grade point average for students 43 and older is 2.0 (C), which is slightly higher than the average student. Of the 36 recorded students who have taken Intermediate Algebra from the Spring of 2006 until the Fall of 2011, the average age is 36 and the average grade is 1.95 (C). Moreover, the correlation coefficient for the student ages and grades of Intermediate Algebra students is $r = .35$ —this also reveals that there is no relationship between student age and the grade that he/she will make in intermediate algebra. Note that .35 is closer to 1 than .042, so age is has a closer relationship to grades in intermediate algebra than in LE Basic Math. The graphs are given below:



Although this paper does not focus on non-developmental math courses, it is interesting to note that 70% of all students (433 students) taking math courses (developmental and regular courses) at Victory University earned an average grade of 2.0 (C).

The LE Basic Math Course in the Fall of 2008 had 11 students with an average age of 34 and an average grade of 1.09 (D). Similarly, the LE Basic Math Course in the spring of 2011 had 8 students with an average age of 48 and an average grade of 2.25 (C). For each course, the correlation coefficient r is under .8 (.34 and -.27 respectively) so one cannot make a strong case for a relationship between the student's age and academic performance. However, the spring of 2011 class has the higher grade point averages and the average age is also higher.

Three students over the age of 59 and two students over 40 were given extra reinforcement within MyMathLab/MathXL. Though these students are not strong in mathematics, they were able to pass their respective developmental math courses with the grade of a C. These students noted that the view an example feature and the help me solve this feature helped them to study concepts that they did not understand from the lecture. Unfortunately, students in the fall of 2008 LE Basic Math class were not afforded this option in the traditional format course.

Discussion

The sole purpose of observing the data above is to help older learners of mathematics excel at a faster rate. However, the data does not substantiate the hypothesis that older students will perform worse than the average/traditional age student. History reveals that older students have performed slightly better. Yet the average age of the students taking developmental math courses at Victory University is 36. What the data does reveal is that the average student taking a developmental math courses is an adult learner (not between the traditional ages of 17-26) who will struggle to pass the course with a grade of C or better. Adult learners in developmental math courses need more support in order to be successful in the course. Looking closely at the data suggests that there are other factors beside age that are instrumental in student performance in developmental math courses:

1. Time devoted to study
2. Aptitude
3. Study Skills
4. Comprehension
5. Utilization of teacher/tutor for outside support
6. Completion of homework and other classroom assignments

The hybrid course reinforces the aforementioned factors within the design of the course. Traditional courses place the burden of excelling these areas on the student with little or no help. With MyMathLab/MathXL students have access to an online tutor more hours of the day than their instructors. Students in the hybrid format can get help with several problems in a more time efficient manner.

Students who are returning back to school after being out of school ten (10) years or more usually are more challenged in recalling basic math facts. Though the data suggests that being out of school for many years does not automatically assume failure, it does not suggest that adult learners of developmental math could not use extra support.

Conclusions

All adult learners of mathematics could use help with mastering the material presented in developmental math courses at Victory University. As in the LE Basic Math courses observed in this study, students who are exposed to learning technologies outperform students within traditional class settings. Helping adult learners to use technology necessary for completing math assignments can be well worth the investment. However, there are some disadvantages to using the math learning technology.

The six students observed in this study needed a lot of help initially with understanding how to operate the computer application. Major disadvantages include:

- Helping students to understand MyMathLab/MathXL takes away from curriculum time
- Challenging internet connections and servers not being available is sometimes discouraging to the students
- Requiring an additional cost to the student sometimes is not favoured by colleagues
- Logging in with the access code and course id usually delay the course's start date by 1 or 2 weeks for most adult learners who have been out of school for several years
- Learning the new technology takes about 2 to 3 weeks in order to become proficient
- Some students will find learning both technology and mathematics overwhelming and drop the course

Although there are several disadvantages, they are not insurmountable. In fact, the benefits compensate for the disadvantages list above—the result is accelerated levels higher learning. The fact that the average student in the MyMathLab/MathXL based LE course has an average grade of 2.25 (C) versus the average grade of 1.09 (D) in a traditional LE math course reveals the potential usefulness math learning technology within the classroom.

Of the students observed, they all claimed that they were able to identify the areas that they are deficient in and spend the time on the computer “filling in the gaps” of their learning. For a couple of the students, MyMathLab/MathXL assignments were more effective than one on one tutoring, because they could play and re-play the explanation to the problems until the concept was understood. Of course, MyMathLab/MathXL is not a replacement for necessary tutoring, but should be utilized before the student access a tutor. MyMathLab/MathXL allows students to use homework time more effectively, which increases their likelihood of mastering the material. Moreover, 4 of the 5 students observed believed that using MyMathLab/MathXL to complete assignments helped them to develop confidence in solving math problems.

Implications

Assuredly, professors still need to enforce the learning and understanding of mathematical concepts of mathematics while using technology. However, more research is necessary to determine if technology can support true understanding of mathematical concepts vs. building basic skills. Another desire of many math professors is to give students feedback in real-time, while they are working on the math

problem. Recommendation: Installation of real time software that assesses the student at each level of the problem and remediates the student accordingly. The “Help me solve this feature moves in this direction—precisely because it breaks the problems down into smaller chunks. However, more scaffolding is needed. At the level at which the student is unable to complete the problem, the student will be able to click a link to learn the missing concept via view an example, PowerPoint lesson, animation and/or video lecture. Currently, this technology is not available.

More research is necessary to ensure the viability of developmental math learning with the use of technology over learning within the traditional classroom lecture format. Yet there is a lot of research that supports this claim.² For example, if one were to track the amount of time spent in MyMathLab/MathXL by the average adult developmental math learner, would there be a correlation to the grade point average attained in the course? For what percentage of students does technology provide a hindrance for developmental math learning? These and other related questions provide implications for further research.

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² Kidd, T. & Jared Keengwe. (2010.). *Adult learning in the digital age: Perspectives on online technologies and outcomes*.